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A NEW SPECIES OF TUBE-NOSED FRUIT BAT
(*NYCTIMENE*) FROM THE BISMARCK ARCHIPELAGO,
PAPUA NEW GUINEA

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Tube-nosed fruit bats of the genus *Nyctimene* (Chiroptera, Megachiroptera, Pteropodidae), and its sister-taxon *Paranyctimene*, are unique among the various taxa that comprise the family Pteropodidae, being distinguished by their peculiar tubular nostrils. The nine currently recognized species of *Nyctimene* occur in Indo-Australia from Timor, through Sulawesi and the Moluccas, New Guinea and tropical Australia, and the Bismarck and Solomon Islands to Santa Cruz Island.

In the summer of 1979, the Taylor South Seas Expedition from the Natural History Museum of Los Angeles County (LACM), led by one of us (Smith), visited the Bismarck Islands of New Ireland and New Britain for the purpose of surveying the bat fauna of this poorly known region. Preliminary results of this expedition were reported by Smith and Hood (1981). A more extensive report of collections made, plus the results of a second expedition (1981) to the Bismarcks (including Manus and Duke of York islands), is in progress. In addition to the capture of many species new to the fauna of the Bismarcks, we encountered an undescribed species of *Nyctimene*, which is diagnosed and discussed below.

Nyctimene masalai, new species

Demonic Tube-nosed Fruit Bat

Holotype.—LACM 65798, adult male (preserved in alcohol, skull removed) collected on 9 July 1979 by James Dale Smith

(original number 4522) at Ralum, 10 m., New Ireland Island, New Ireland Prov., Papua New Guinea (lat. $3^{\circ} 33' S$, long. $152^{\circ} 22' E$).

Paratype.—LACM 65799, young adult male (preserved in alcohol, skull removed) collected on 19 July 1979 by James Dale Smith (original number 4878) at 2 km. NW Hilalon, sea level, New Ireland Island, New Ireland Prov., Papua New Guinea (lat. $3^{\circ} 51' S$, long. $152^{\circ} 39' E$).

Distribution.—Bismarck Archipelago, Papua New Guinea, known only from New Ireland Island.

Diagnosis.—Size moderately large (see measurements below). Color mottled, dark reddish brown above; black, middorsal strip (5 mm. wide) from back of crown to base of tail; grayish white with yellowish brown wash below; spots on wings, ears, and narial tubes whitish. Cranium narrow and elongate (rectangular rather than squarish); rostrum relatively long and narrow; frontal sinuses inflated and parallel to each other (not converging in supraorbital region); maxillary toothrows straight, converging anteriorly; bony palate moderately domed (not flat), deepest anterior to second upper premolars; postdental palate not markedly pandurate; pterygoid wings low. Dentition with marked reduction of coronal cusps; canines relatively short and broad-based, upper pair lacking labial cusps; P₃ and p₃ unicuspid and nearly subconical.

Measurements.—Selected cranial and external measurements (in mm.) of holotype and paratype, respectively: condylobasal length, 30.7, 29.7; zygomatic breadth, 20.4, 20.9; mastoid breadth, 13.7, 13.5; interorbital breadth, 6.2, 5.7; breadth across canines, 5.6, 5.8; length of maxillary toothrow, 10.9, 10.4; breadth across upper molars (M1-M1), 8.3, 9.0; length of mandibular toothrow, 12.5, 12.1; length of mandible, 24.0, 23.4; height of coronoid process, 13.3, 13.7; length of head and body, 103, 94; length of tail, 22, 21; length of hind foot, 14, 13; length of ear, 14, 14; length of forearm, 67.5, 63.5; weight (grams), 52.3, 45.2.

Description.—Head long and narrow; face deep; ears broad, bluntly pointed; narial tubes long, directed anteriorly; flight membranes dark brown; wing attached to dorsal surface of foot at base of third toe; large white blotches on dorsal surface of forearm and all digits of wing (spots on membrane between fingers pale yellowish brown); leading edge of ear pinna and narial tube with white spots.

Pelage and Coloration.—Dorsal pelage long (8-9 mm.) and lax; extending along pectoral limb to proximal third of forearm and

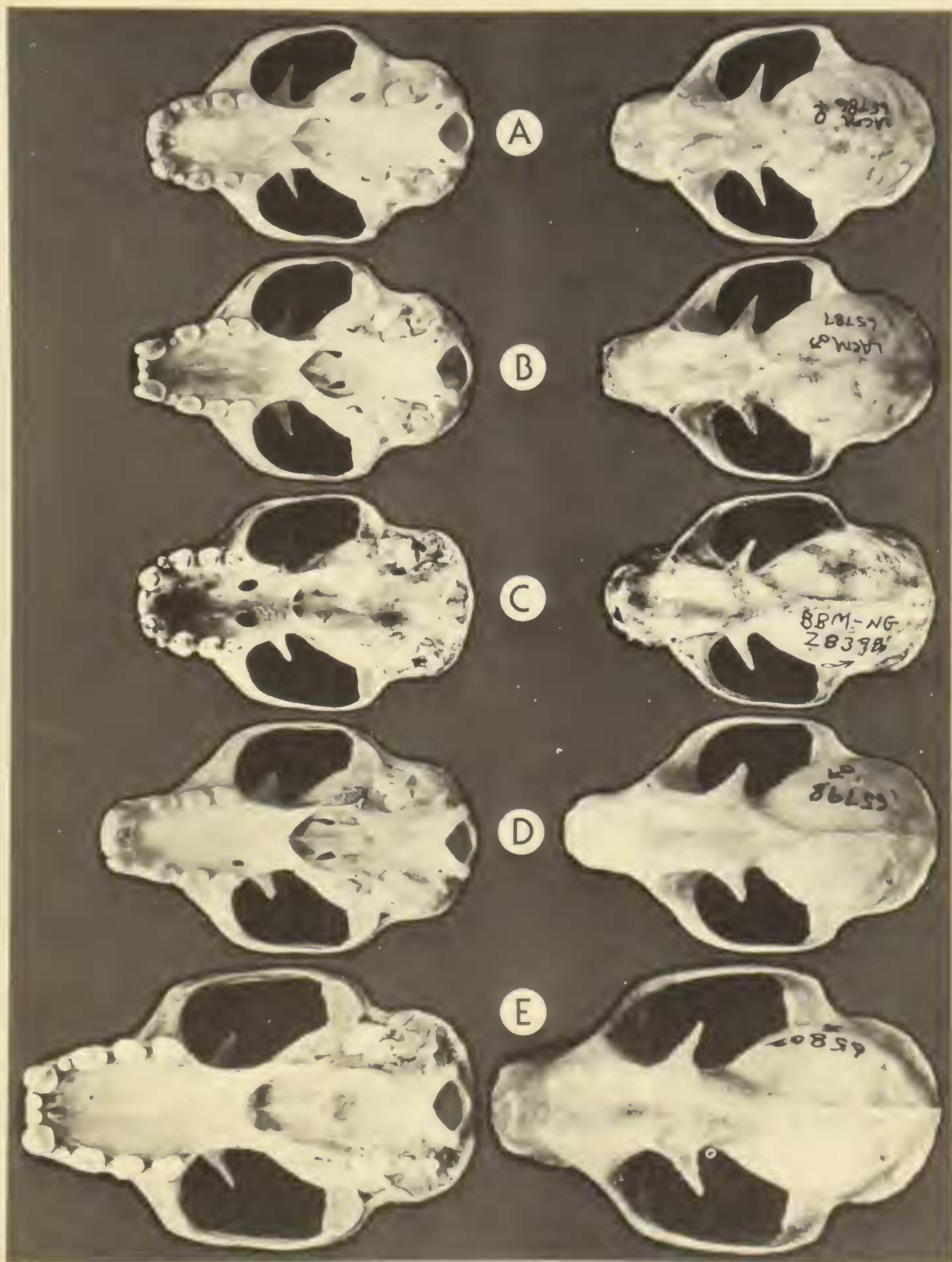


FIG. 1.—Dorsal and ventral views of skulls of Bismack *Nyctimene*. A, *N. albiventer* (LACM 65786); B, *N. uzcaccia* (LACM 65787); C, *N. cyclotis* (BBM-NG 28398); D, *N. masalai* (LACM 65798, holotype); E, *N. major* (LACM 65802). See text for discussion.

also extending to knees in a V-shaped pattern with apex at base of tail; hairs tricolored (dark brown at base, mid-region pale grayish brown, reddish brown at tip); overall coloration of back mottled dark reddish brown; dark black middorsal stripe (5 mm. wide) from back of crown to base of tail. Ventral pelage short (4-5 mm.) and sparse; throat and middle portion of chest and abdomen grayish white; lateral regions and lower flanks with yellowish brown wash.

Cranium.—Rostrum relatively short and narrow (Fig. 1D); breadth across lacrimal foramina only slightly greater than width of rostrum and interorbital region; braincase long and narrow (not globose); zygomatic arches flared to the side, straight for most of their length and paralleling longitudinal axis of cranium. The foregoing features give the cranium a roughly rectangular shape (viewed from above). Frontal sinuses inflated and lying parallel to each other, not converging appreciably in supraorbital region, and separated by a medial groove; sagittal and lambdoidal crest low. Viewed in profile, skull rather planar (Fig. 2B); rostral portion of nasals flattened; forehead rising with a gentle angle to supraorbital boss; top of skull flat to about middle of braincase, then gently curved ventrally; braincase not deflected below alveolar plane. Bony palate long and narrow; gently domed, deepest portion anterior to second upper premolars; postdental palate not markedly pandurate; pterygoid wings low (Fig. 2B); maxillary tooththrows straight (not bowed or arcuate), converging anteriorly.

Dentition.—Dental formula I 2/0, C 1/1, P 3/2, M 1/2 = 24.

Incisors. Upper incisors tightly placed between upper canines; each subtriangular with a strong central cusp; narrow cingular shelf on posterior face extending to anterolateral face of tooth. Lower incisors absent as is characteristic of all members of the genus.

Canines. Upper canines relatively short; posterior cingular shelf confined to internal, basal portion of tooth (Fig. 3A); labial margin of cingulum with shallow notch (this may be exaggerated as tooth wear progresses); external cusp, or indication thereof, absent; rear face of canine flat. Lower canines short, broad at base; posterior cingulum extending rearward from middle of labial margin as a gently spiralled scallop to internal apex of canine.

Premolars. First upper premolar (P2) reduced to small spicule; coronal surface generally round and flat; second upper premolar (P3) most prominent of postcanine teeth; single strong

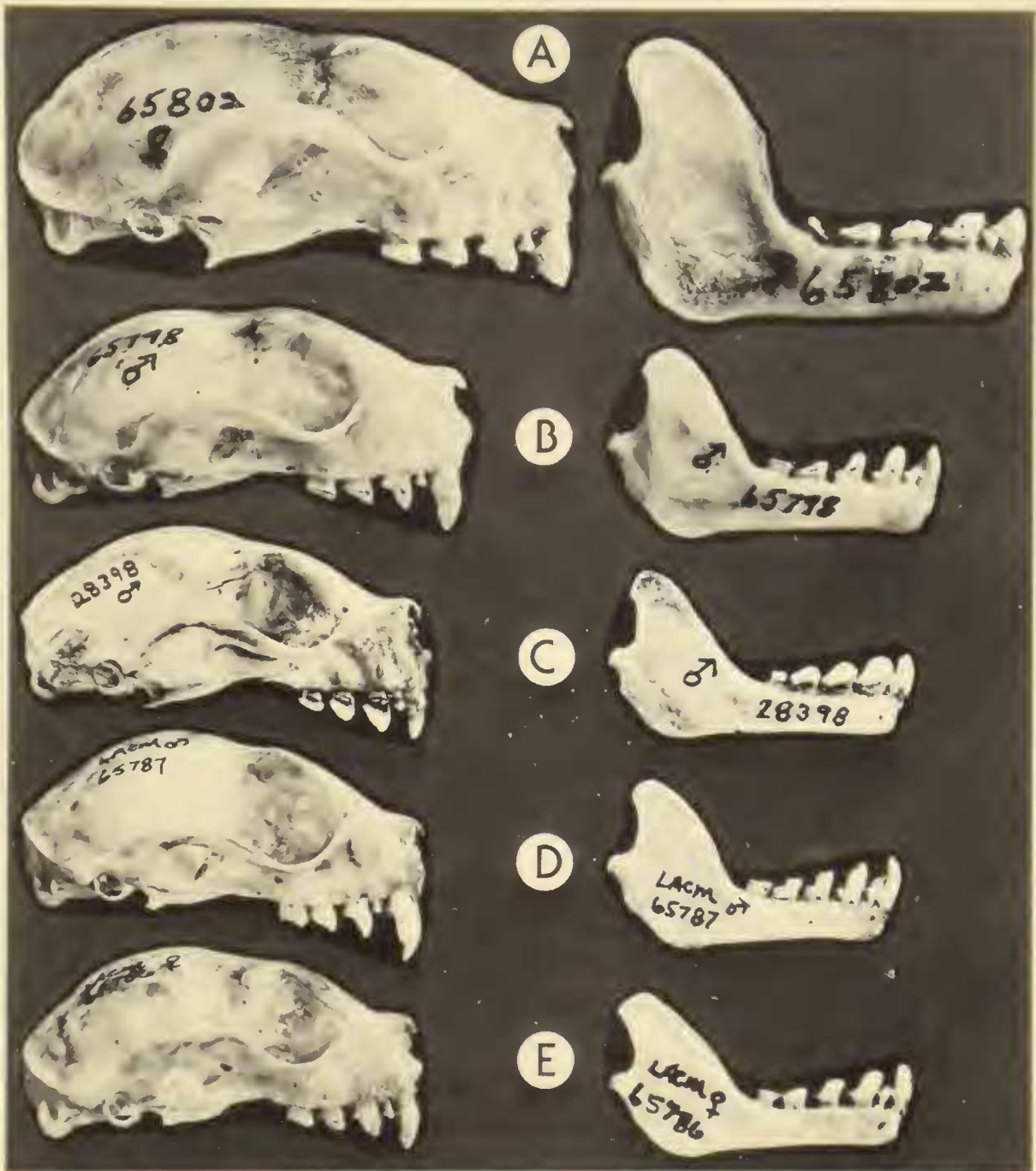


FIG. 2.—Profile of skull and lower jaw of Bismarck *Nyctimene*. A, *N. major* (LACM 65802); B, *N. masalai* (LACM 65798, holotype); C, *N. cyclotis* (BBM-NG 28398); D, *N. vizzaccia* (LACM 65787); E, *N. albiventer* (LACM 65786). See text for discussion.

cusps on anterior, external portion of tooth (Fig. 3A); internal cusp absent (perhaps it has fused completely with main cusp); short labial and lingual ridges extending rearward from central cusp, then dropping abruptly to shelflike heel of tooth; third upper premolar (P4) subequal in size to P3; strong anterior, external cusp; lower anterior, internal cusp; lobate heel angled lingually. First lower premolar (p2) reduced in size; crown generally flat and with short external cusp; second lower premolar (p3) with strong, high cusp on anterior, external portion of tooth

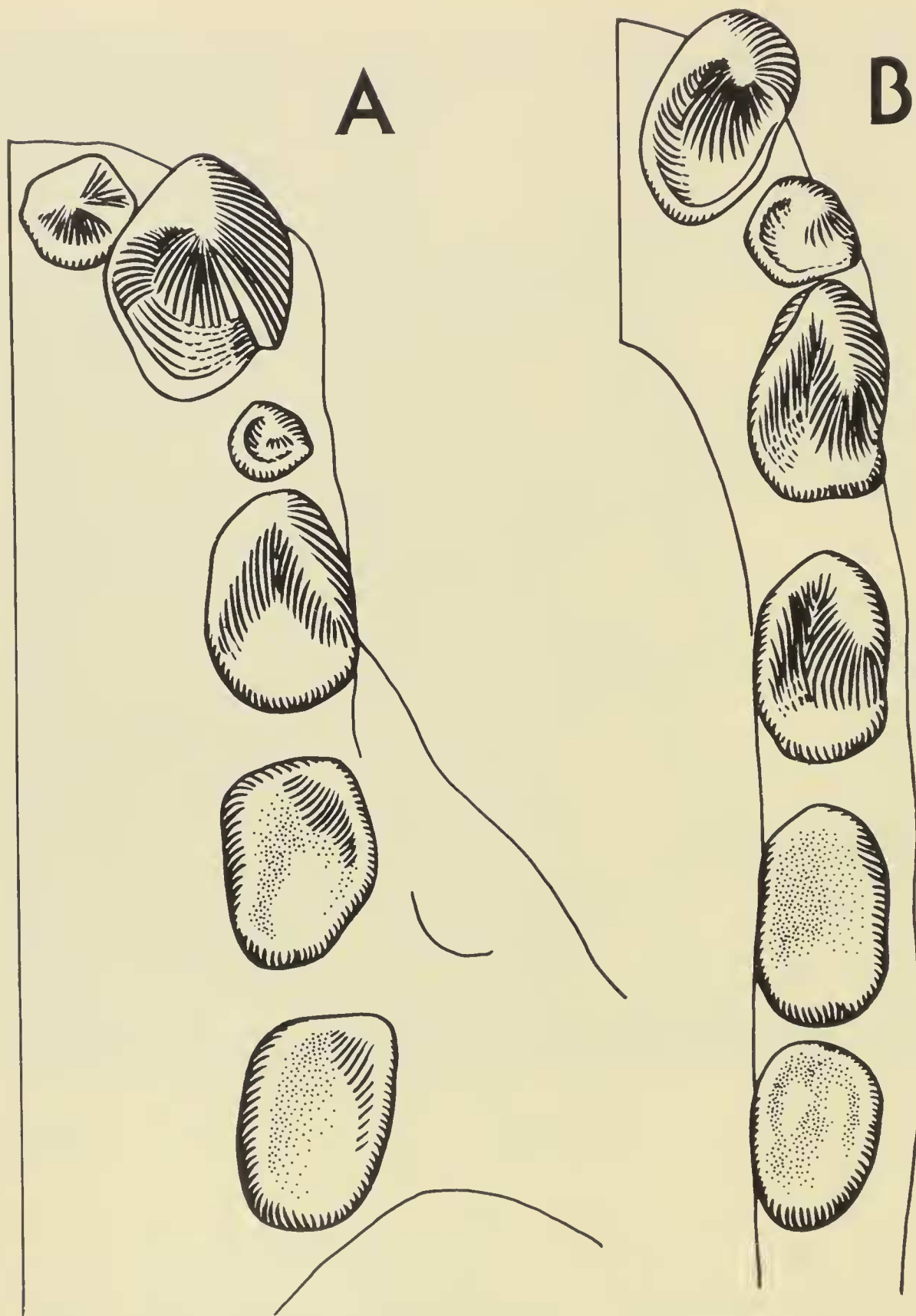


FIG. 3.—Upper (A) and lower (B) dentition of *Nyctimene masalai* (LACM 65798, holotype).

(Fig. 3B); internal cusp absent (again, probably fused with main cusp); short labial and lingual ridges extending rearward from central cusp, then dropping abruptly to shelflike heel of tooth; third lower premolar (p4) slightly smaller than p3; anterior,

external cusp high; internal cusp not distinct; these two cusps connected by a ridge that arcs around anterior margin of tooth; posteriorly, internal and external ridges drop rather abruptly to heel of tooth.

Molars. First and only upper molar (M1) subequal in size to P4; cusp positions and ridges similar to those of P4 but much lower; tooth nearly flat as viewed in profile. First lower molar (m1) similar to p4 in size and coronal morphology; anterior portion of tooth only slightly higher than heel; second lower molar (m2) slightly shorter than m1; no distinct cusps apparent, crown flat.

Soft palate.—Entire length of soft palate covered with 20-21 palatal ridges, eight or nine of which are interdental; first ridge short, extending straight across palate between first upper premolars; second through fifth or sixth ridges similar in shape with a lateral branch extending anteriorly from toothrow at about 45° angle, then bending sharply to cross midline at perpendicular angle; next few ridges with indentation medially, may connect at midline; all aforementioned ridges rather thick, rounded, and separated by deep grooves, their surface wrinkled. Posterior to interdental ridges is a series of more widely spaced, delicate ridges clothed by many sharply pointed, toothlike papillae, anteriormost of which randomly and irregularly traverse soft palate; many do not reach midline; last eight or nine postdental ridges more or less regular in form, spacing, and nearly all extend, unbroken, across soft palate.

Etymology.—The epithet for the new species, *masalai*, is taken from the Tolai language and means forest demon or devil.

COMPARISON AND DISCUSSION

The most recent critical review of the tube-nosed fruit bats is that by Andersen (1912b:681-722, 828). He treated 13 species of *Nyctimene* (*papuanus*, *albiventer*, *minutus*, *varius*, *cyclotis*, *cephalotes*, *geminus*, *major*, *scitulus*, *lullulae*, *aello*, *robinsoni*, and *certans*). The holotypes of these, except for *cephalotes* (not examined by Andersen and apparently lost), are housed in the collection of the British Museum (Natural History). All except *N. cephalotes* (Pallas, 1767), *N. albiventer* (Gray, 1862), *N. major* (Dobson, 1877), *N. aello* (Thomas, 1900), *N. robinsoni* Thomas, 1904, *N. major lullulae* Thomas, 1904, and *N. certans* Andersen, 1912a were described by Andersen (1910). Since the review by Andersen (1912b), seven additional taxa of *Nyctimene* have been

described: *N. vizcaccia* Thomas, 1914, *N. draconilla* Thomas, 1922a, *N. celaeno* Thomas, 1922b, *N. sanctacrucis* Troughton, 1931, *N. bougainville* Troughton, 1936, *N. malaitensis* Phillips, 1968, and *N. albiventer minor* Phillips, 1968. *Paranyctimene raptor* Tate, 1942, also was described after Andersen (1912b). Tate (1942: 341-343) discussed some, but not all, of these taxa in his account of pteropodids contained in the Archbold collections. Likewise, Laurie and Hill (1954: 46-48) treated most, but not all, of these bats. They assigned the various taxa of *Nyctimene* known to occur in the geographic area covered by them to species and subspecies, but did not discuss or otherwise justify these assignments. More recently, several other workers (Phillips, 1968:817-825; McKean, 1972:16-20; and Koopman, 1979:12) have remarked on regionally limited taxa of *Nyctimene*. To date, however, the genus remains unreviewed in its entirety.

Like many bats from the Indo-Australian region, most species of *Nyctimene* are represented only by the holotype or extremely small series (one or two in most cases) from scattered localities, many of which are islands. In addition, much of the crucial cranial material is damaged or has heavily worn dentition, thereby limiting critical comparisons and analyses of characters. These troublesome factors are further aggravated by a rather high degree of individual variability that is apparently common among pteropodid bats. In the past, species of *Nyctimene* have been based mostly on coloration and overall size. In preparing the description on *N. masalai*, we have examined and directly compared it with the 15 holotypes of *Nyctimene* in the British Museum (Natural History), holotypes of *N. malaitensis* and *N. albiventer minor* (Bernice P. Bishop Museum, Honolulu), and representative series of all other species of *Nyctimene* except *N. sanctacrucis*. In addition, we have attempted to identify and use characteristics in the diagnosis and description that seem applicable to all taxa of *Nyctimene*.

Nyctimene masalai is easily distinguished from *N. m. major*, with which it is sympatric, on the basis of large overall size of the latter (Figs. 1E and 2A). The cranium of *major* is flatter in profile, much more massive, and the dentition is characteristically more cuspidate than that of *masalai* (Fig. 1E). *Nyctimene masalai* approaches *N. m. scitulus* in overall size, but remains distinct because of the qualitative characters mentioned above. This is also the case with *N. geminus*, which currently is regarded as a geographic race of *major*. *Nyctimene lullulae* (also regarded as a

subspecies of *major*) is slightly smaller than *masalai*, but again, is distinguished by cranial and dental features typical of *major*. *Nyctimene robinsoni*, *N. aello*, and *N. celaeno* (regarded as a race of *aello* by Laurie and Hill, 1954) occupy geographic ranges that are allopatric to that of *N. masalai*. *Nyctimene robinsoni*, an apparently close relative of *N. major*, is distinguished from *masalai* by the same general suite of characters that separates *masalai* from *major*. Large size, highly cuspidate dentition, and a unique broad middorsal stripe easily separate *N. aello* and *N. celaeno* from *N. masalai*.

Nyctimene masalai is slightly larger in overall size compared to *N. cyclotis* (Figs. 1C and 2C). It is conceivable that these two occur sympatrically (*cyclotis* having been recently reported from New Britain Island by Smith and Hood, 1981), but as yet they remain allopatric. While similar in size, *cyclotis* is readily identified by its generally dark, extremely long and wooly pelage, as well as uniquely cuspidate postcanine dentition (Fig. 1C). The premolars and molars of *cyclotis* are round as opposed to rectangular and the premolars have three strong cusps; the palate is markedly arcuate. The cranium of *cyclotis* tends to be more squarish than rectangular. The large round palatal fenestrations shown in Fig. 1C are not wholly artifactual, but are frequently encountered in specimens of *cyclotis*, and are often asymmetrical. They do not occur in all specimens, but their form, position, and incidence of occurrence seem consistent enough to consider them a feature of the species.

The two remaining species that occur in sympatry with *N. masalai* are *N. albiventer* and *N. cephalotes*. They are similar in size, but both are smaller than *masalai*. The Bismarck Archipelago (including the Admiralty Islands) is the only geographic area in which *albiventer* and *cephalotes* are known to occur sympatrically. *Nyctimene albiventer*, in its current context, is a wide-ranging species that occurs from the northern Moluccas through New Guinea, the Bismarcks and the Admiralties, to the Solomon Islands. Laurie and Hill (1954) placed *N. papuanus*, *N. draconilla*, and *N. bougainville* as subspecies of *N. albiventer*. With the exception of *bougainville* (see below), these associations seem to be correct, although Koopman (1979:6) regarded *draconilla* as a distinct species (the specimens referred to *draconilla* by Greig-Smith, 1975, and mentioned by Koopman, 1979, as partial justification of this arrangement, are *Paranyctimene raptor*). The name *cephalotes* was first introduced into the Bismarck area when

Laurie and Hill (1954) relegated *N. vizcaccia* Thomas, 1914, to subspecific status under *N. cephalotes*. Formerly, *cephalotes* was applied to bats that occurred generally west of New Guinea (Timor, Peleng Island, off the east coast of Sulawesi, and the Moluccas); one specimen from Numfoor Island, Geelvinck Bay, Irian Jaya, was also assigned to *cephalotes* (Laurie and Hill, 1954; Koopman, 1979).

In the preparation of this description of *masalai* and the development of comparative criteria for species of *Nyctimene*, we stumbled inadvertently onto a problem concerning the identity of *albiventer* and *cephalotes*. Neither *albiventer* nor *cephalotes* is especially well defined in the literature and, as noted above, the holotype of the latter appears to be lost. We arrived at our understanding of *cephalotes* by first defining the nature of *albiventer*. For this, we used the holotypes of *albiventer*, *papuanus*, and *dracconilla* as well as considerable comparative material from the mainland of New Guinea. We regard *albiventer* to be a moderately small species with a narrow, brownish black middorsal strip. The dorsal pelage is not mottled and the venter is generally uniformly whitish or yellowish white. The cranium is squarish with an extremely short rostrum and globose braincase (Figs. 1A and 2E), and the palate and maxillary toothrow are broad and arcuate rather than narrow, straight-sided, and convergent anteriorly. The second upper premolar is bicuspidate with a strong external cusp and a lower, usually prominent, internal cusp (Fig. 1A), but tooth wear may obliterate the internal cusp. The second lower premolar also is cuspidate with a strong external cusp, usually flanked by a short anterior and posterior loph, and a prominent internal cusp. There is some individual variation in the distinctness of the internal cusp throughout the geographic range of the species and wear quickly obliterates its appearance. However, this tooth and its upper counterpart are always broad and round rather than long and narrow. All of these features easily distinguish *albiventer* from *masalai*. They do not, however, characterize tube-nosed fruit bats from the Solomon Islands that have been previously assigned to *N. albiventer bougainville*.

With *albiventer* so defined, we are left with one remaining species in the Bismarcks—supposedly *N. cephalotes*. This bat agrees in size and general external appearance with *albiventer*, but its dorsal pelage is usually mottled and the venter is often darker. In describing *N. bougainville*, Troughton (1936) made similar observations in his comparison with *N. papuanus*, and these appear to

have influenced Pohle's (1953) association of *bougainville* with *albiventer*. Subsequent authors have followed this assignment. More importantly, the cranium and dentition of the remaining taxon differ considerably from those of the form that we regard as *albiventer*. The cranium is rectangular with a relatively longer rostrum than in *albiventer*, and the braincase is elongate, not globose (Fig. 1B). The second upper and lower premolars lack a distinct internal cusp. Often there is a marked, flangelike ridge sweeping in a graceful and gentle curve from the posterior internal margin of the cingulum upward to the apex of the prominent and narrow external cusp (Fig. 1B). This is especially apparent on unworn teeth. The teeth are usually longer and somewhat narrower than those of *albiventer*, although this tendency may be obscured by wear and erosion. The preceding features characterize specimens formerly referred to *N. albiventer bougainville* from the Solomon Islands, the holotype of *N. vizcaccia*, and a larger series of topotypes (Ruk, Rooke, or Umboi Island) in the Bernice P. Bishop Museum.

Finally, we compared the Bismarck and Solomon specimens with those referred to *cephalotes* from Peleng Island and the Moluccas. The latter agree in external appearance and general shape of the cranium. The crania of Bismarck and Solomon specimens tend to be less rectangular than either those of *cephalotes* or *masalai*. Specimens of *cephalotes* from Peleng Island and the Moluccas are larger in overall size, and the upper and lower premolars have a moderately prominent internal cusp. This is also true of the specimen from Numfoor. On the lower premolar, this cusp may be reduced to a promontory or shoulder on the internal ridge that extends from the posterior cingulum to the apex of the external cusp. Thus, given these differences, we regard *Nyctimene vizcaccia* Thomas (1914) to be a valid species, separate and distinct from *cephalotes* and *masalai*, and occupying a geographic range in the Bismarck and Solomon Islands. All three taxa appear to be allied and may ultimately be regarded as members of a "*cephalotes*-group." Furthermore, we regard *N. bougainville* from the Solomon Islands, heretofore assigned to *N. albiventer*, as a junior synonym of *N. vizcaccia* and as a valid subspecies of that species, *Nyctimene vizcaccia bougainville*, new combination. There seems to be little evidence to warrant recognition of the subspecies *minor* from Fauro, Choiseul, and Santa Ysabel islands. Although slightly smaller in overall size, representative specimens are not markedly removed from the range of variation in *N. v.*

bougainville, and we therefore regard *N. albiventer minor* as a junior synonym of *N. v. bougainville*.

Nyctimene masalai differs from supposed *cephalotes* from Peleng Island and the Moluccas by being larger in overall size, having a somewhat broader, yet rectangular cranium, and a relatively longer rostrum. The dentition of *masalai* is, perhaps, the most reduced of any species of *Nyctimene* in terms of coronal cuspidation (Fig. 3). *Nyctimene malaitensis* Phillips (1968) is known only from the type specimen from Malaita Island, Solomon Islands. It appears to be a species distinct from *N. v. bougainville* which is smaller in all respects. *Nyctimene malaitensis* does approach *masalai* in size, but the cranium is less rectangular, the rostrum is shorter and broader, and the palate is flat, not domed as in *masalai*. The dentition of the holotype of *malaitensis* is badly worn. The foundations of the teeth are broad and rounded, and those of the upper and lower second premolars appear to have supported internal cusps.

SUMMARY

A new species, *Nyctimene masalai*, is described from New Ireland Island, Bismarck Archipelago, Papua New Guinea. The new species is compared with all other species of *Nyctimene* except *N. sanctacrucis*. In these comparisons, useful characteristics for identifying the species of *Nyctimene* are presented, and *Nyctimene albiventer* and *N. cephalotes* are discussed in detail. As a result, *Nyctimene vizcaccia* is raised to species rank. *Nyctimene bougainville*, from the Solomon Islands (previously assigned to *N. albiventer*), is placed as a junior synonym of *N. vizcaccia*, and Solomon representatives are assigned to *Nyctimene vizcaccia bougainville*. *Nyctimene albiventer minor*, also from the Solomons, is put into the synonymy of *N. vizcaccia bougainville*.

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